Eval/Demo Planning for the Joint Countermine ACTD

Mine Countermeasure Operations

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ACTDs are a new and innovative aspect of DoD acquisition reform, just initiated in fiscal 1995 by the Deputy Under Secretary of Defense for Advanced Technology [DUSD(AT)]. They represent an attempt to accelerate the acquisition process, and encourage the acquisition community to cooperate earlier and more fully with the intended warfighting user.[1]

CLAUSEN POWER BLADE CLEARING PATH THROUGH OBSTACLES AND BURIED MINES. LANDING CRAFT, AIR CUSHION (LCAC) IS IN THE BACKGROUND.

Background

Demonstration 1 (Demo I) was the first of two Joint Countermine (JCM) Advanced Concept Technology Demonstrations (ACTD) to demonstrate the capability of conducting seamless amphibious mine countermeasures (MCM) operations from sea to land.[2] Focusing on near-shore capabilities, Demo I emphasized in-stride detection and neutralization of mines and obstacles in the beach zone and on land.

Conducted by the Office of the Secretary of Defense (OSD) and the U.S. Atlantic Command (USACOM) in late summer 1997, Demo I integrated the JCM ACTD forces into a large-scale Joint Task Force Exercise (JTFEX), employing prototypes from Advanced Technology Demonstrations (ATD) and developmental acquisition systems alongside operational forces using current countermine systems.[3] Ultimately, the JCM ACTD forces intended both demonstrations to serve as a sound basis for investment decision recommendations prior to commitment to systems acquisition.

Scenario

Employing tactics, techniques, and procedures (TTP) from the existing doctrine of Operational Maneuver From the Sea (OMFTS), the Demo I JCM ACTD forces successfully demonstrated capabilities for safe transit of amphibious forces across a beach defended by a light defense force, employing mines and complex obstacles.

The Demo I scenario called for the JCM ACTD forces to conduct clandestine surveillance and reconnaissance to determine if gaps in the marine and land minefields could be exploited to allow safe transit of amphibious forces to reach their objective. If no gaps existed, their mission was to execute the overt reconnaissance, detection, neutralization, and clearance operations necessary to en-

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Photos courtesy The John Hopkins University sure mine and obstacle clearance for the safe transit of forces.

Using Distributed Interactive Simulation (DIS) – in this case, a campaign-level simulation, in which output was distributed to command nodes via the tactical command and control network – to the fullest extent during the demonstration, the JCM ACTD forces also demonstrated further command and control links between MCM units and operational commanders.

Throughout the entire Demo I scenario, extensive operational user [USACOM] involvement in the JCM ACTD supported the development and evaluation of doctrine, TTP, and the assessment of organizational impacts of the new technology prototypes. OSD and USACOM viewed the warfighter's perspective as significant input to these acquisition decisions because the ACTD was and remains committed to the following three objectives:

- Gain understanding and evaluate military utility before committing to systems acquisition.
- Develop corresponding concept of operations and doctrine.
- Rapidly provide enhanced operational capability.

A "System of Systems"

The JCM ACTD is a "system of systems," with complex interfaces among the novel systems being evaluated in the ACTD as well as interrelationships with the legacy countermine systems that are currently fielded. The challenge for planning the test and evaluation approach for the JCM ACTD was to give users proper observability into the military utility of the novel systems, thereby allowing them to make the right decisions with respect to those systems.

Early in the development stage, OSD and USACOM recognized the applicability of the demonstration planning and evaluation approach developed for Demo I ACTD. As a result, they recommended it to other ACTD managers for ACTDs of the system-of-systems class.

This article describes the philosophy and approach developed by the Joint Program Office in conducting and analyzing the following key elements of the JCM ACTD:

- **Development of an integrated scenario to demonstrate and motivate use of 12 novel countermine systems.** The Joint Countermine ACTD employed prototypes from ATDs and preproduction phases of the development cycle along with fielded equipment in live demonstrations. Selected items of equipment and simulations remained with the operational user for a two-year extended evaluation.[4] Table 1 provides a summary of the novel systems included in the JCM ACTD.

- **Employment of a sophisticated modeling and simulation (M&S) tool.** A robust M&S effort, the Joint Countermine Operational Simulation (JCOS) expanded the information base obtained from the live demonstrations through constructive modeling and DIS.

- **Innovative use of enhanced Command, Control, Communications, Computers, and Intelligence (C^4I) network architecture as the primary automatic data collection mechanism**.[5] C^4I connectivity and notional architectures for MCM were also demonstrated.

- **Development of a Measures of Effectiveness/Measures of Performance (MOE/MOP) hierarchy for the system-of-systems situation.**

COASTAL BATTLEFIELD RECONNAISSANCE AND ANALYSIS (COBRA), CONFIGURED IN AN UNMANNED AERIAL VEHICLE.

Getting Started

Initially, we were concerned that our goals and objectives were too lofty to be met by merely staging one or two large-scale military demonstration exercises involving 12 novel systems of varying maturity and technical risk. Eventually, we produced a comprehensive data gathering and analysis plan, integrating results of other test programs and simulation studies, which established a methodology for accomplishing the objectives we established for the ACTD.

TABLE 1. Twelve Novel Systems Tested by the JCM ACTD

Elements	*Description*
Navy Systems	
Advanced Sensors	Underwater mine detection, classification, and identification (D/C/I) in support of finding minefield gaps. Advanced sensors will be housed in a remotely piloted, semi-submersible, low-observable vehicle. Sensor fusion will provide D/C/I against all sea mines. System endurance will provide an 8- to 12-knot search speed for up to 24 hours on a single tank of fuel.
Magic Lantern (Adaptation)	Rapidly detect and classify minefields and obstacles in the very shallow water, surf zone, and craft landing zone. The system will demonstrate the capability of gated, lidar imaging for detection of minefields and obstacles. The system will also employ real-time automatic target recognition and a datalink to ground station for viewing target images.
Advanced Lightweight Influence Sweep System	Sweeps acoustic and magnetic sea mines in the shallow water and very shallow water portion of the assault lanes. The system is an influence sweep that uses a closed-cycle, conductively cooled, superconducting magnet to generate ship-like magnetic signatures, and a pulsed, power-driven underwater sparker to generate ship-like acoustic signatures.
Explosive Neutralization Advanced Technology Demonstration	Breaches a seamless assault lane through minefields in the surf zone and on the beach. The ENATD consists of three explosive systems and a Fire Control System (FCS). The explosive systems are 1) a Line Charge; 2) a Surf Zone Array; and 3) a Beach Zone Array.
Near-Term Mine Reconnaissance System	Provides Theater Commanders with a near-term capability for conducting clandestine minefield reconnaissance from a submarine. NMRS will utilize forward-look and side-look sonars to detect and classify mine-like objects and provide the data back to the host submarine via an expendable fiber optic micro cable.
Littoral Remote Sensing	Using national systems, provide accurate, timely, and tailored intelligence of meteorological and oceanographic (METOC) conditions, natural obstacles, and coastal defenses to tactical forces.
Marine Corps Systems	
Coastal Battlefield Reconnaissance and Analysis	Detect minefields/obstacles in the beach and craft landing zone region. Provide near real-time data to C^4I system. COBRA is an unmanned aerial vehicle-based multi-spectral optical sensor system for detecting minefields/obstacles in the beach/craft landing zone region.
Joint Amphibious Mine Countermeasures	The Joint Amphibious Mine Countermeasures system will provide the Fleet Marine Forces the capability to clear mines and light obstacles from the high water mark to the craft landing zone. The system employs remote-controlled tractors with mechanical, explosive, and electro-magnetic mine countermeasures sub-systems in addition to visual and electronic marking devices.
Joint USMC/Army System	
Off-Route Smart Mine Clearance	Neutralizes off-route smart side attack and top attack mines. The ORSMC System consists of a tele-operated HMMWV platform that replicates critical signatures of target vehicles in order to cause a launch of the smart mine munition.
Army Systems	
Close-In Man Portable Mine Detector	Detects surface and buried metallic and nonmetallic land mines. CIMMD consists of a stand-off Infrared Thermal Imager, and a confirming Ground Penetrating Radar brassboard man-portable mine detector.
Airborne Stand-off Minefield Detection System	The ASTAMIDS will provide the capability to detect and identify the boundaries of patterned and scatterable anti-tank minefields. The ASTAMIDS consists of an airborne imaging sensor and a Minefield Detection Algorithm and Processor, which is a high-speed processor and minefield detection algorithm suite used to process sensor imagery and autonomously detect minefields.
Army Classified Program	Description of system's capabilities and mission is classified.

We decided early on that there should be a current countermine capability baseline established upon which to judge potential enhancements offered by acquisition of the novel systems. This baseline would provide a reference point for judging demonstrated improvements in countermine capability.

An attribute of the analysis methodology is that the baseline and corresponding estimates of improvements in military capability were to be as quantitative and objective an assessment as possible. The analysis philosophy and methodology outlined in this article address the issues confronting our first ACTD, and provide a framework for evaluating the contribution of the novel systems to the countermine mission. We believe the approach can be adapted to any system-of-systems ACTD.

Cutting the Problem Down to Size

As discussed earlier in this article, the JCM ACTD consists of two demonstrations (Demo I and Demo II). Demo I was a scripted exercise, with the Army acting as lead. Demo II is to include large periods of free-play with the Navy acting as lead Service. As with Demo I, Demo II will be part of a large, joint exercise lasting many days.

The scope of Demo II, as with Demo I will be quite large in terms of time, number of participating units, and the number of systems under investigation. Fortuitously, the overall context of a JTFEX (i.e., conducting an amphibious assault on an unfriendly shore) is exactly the mission envisioned for the JCM ACTD. Our first task was to decompose that mission along two dimensions – performance measures and time.

MOPs, MOEs, and COIs

The process of defining MOPs that describe the performance of individual systems and MOEs that evaluate how well these systems accomplish specified tasks is common to almost all test programs. In the case of the JCM ACTD, several factors complicated this process. First, there were no consistent and generally recognized MOEs for countermine functions. Moreover, there were no overarching measures of effectiveness that describe the contribution of countermine to the success of the amphibious assault.

We formulated a three-tier approach to developing quantitative measures for the JCM ACTD. At the top level, working with USACOM, we identified four critical operational issues (COI), taken from the Joint Universal Task List.[6] These COIs form the basis for USACOM's evaluation of the improvement in countermine capability provided by the novel systems. Dropping down a level, we identified a number of MOEs that relate to countermine functions for each sub-phase of the JTFEX. Finally, each sub-phase has a number of participating systems for which we specified a set of MOPs.

Figure 1 illustrates the three levels of quantifiable measures described previously. Although Figure 1 is general for

FIGURE 1.
Integration of MOPs, MOEs, and COIs to Support Overarching Countermine ACTD Objectives

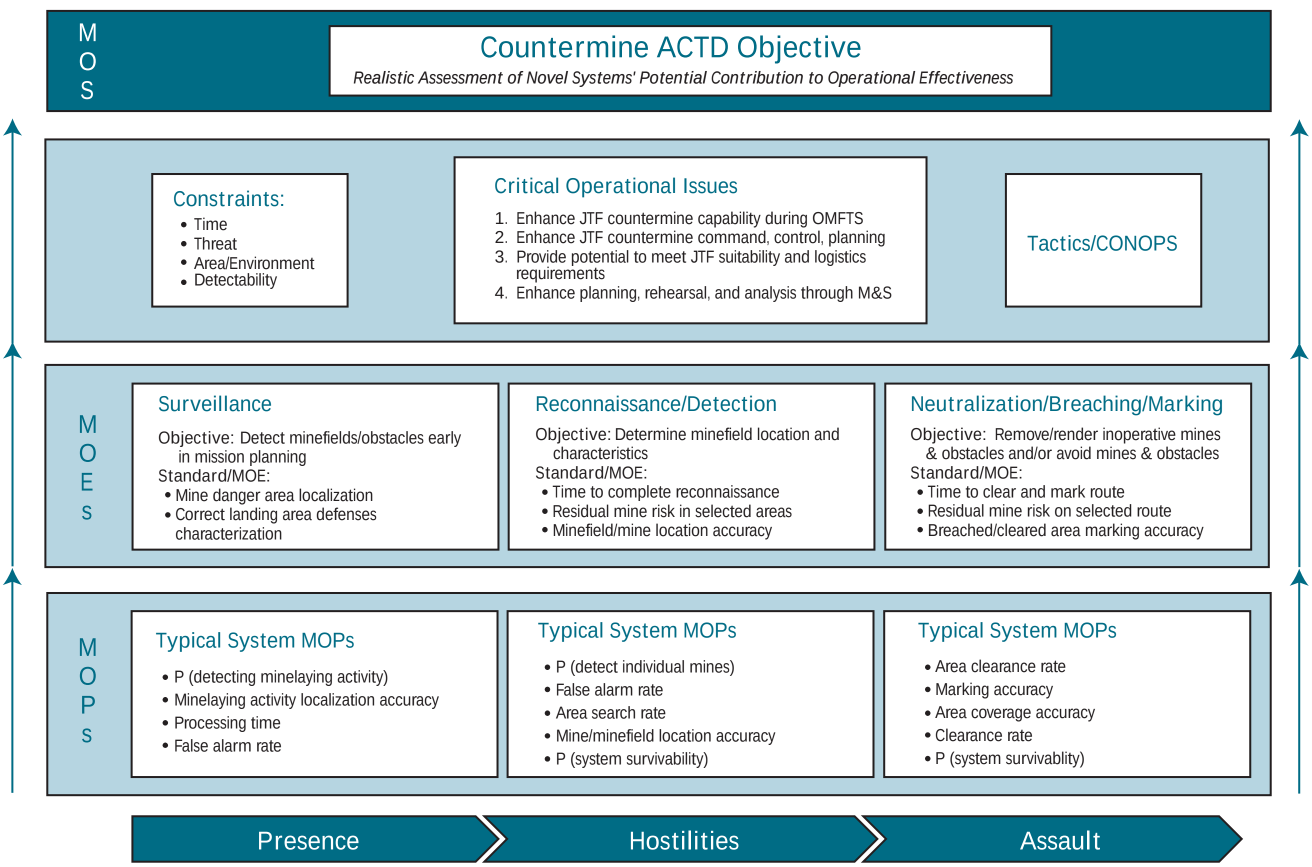


TABLE 2. Ten Sub-Phases of the JTFEX Scenario

Phase	CM OPNS	Title	Description	Novel Systems	Existing Systems
All	Clandestine Intel/Surv/Recon	ISR and CM Planning	Assets utilized for collection, analysis, and dissemination of minelaying activity, mine and obstacle fields. JCOS utilized for course of action analyses.	Littoral Remote Sensing, JCOS	Clandestine: JSOTF SSNs JSTARS U2, etc
Presence	NAVFOR 1	Advance Force Recon	Clandestine recon to discover/create gaps or lightly mined areas in perimeter minefields.	Advanced Sensors (AS)	SMCM AMCM UMCM
Presence Hostilities	ARFOR 1	Border Recon and Breach	Create breach in Koronan border defenses and divert Koronan defense forces from main amphibious landing objectives.	ASTAMIDS CIMMD ACP	Battalion CM Set MICLIC ACE
Hostilities	NAVFOR 2	Beach Approach and Landing Area Recon	Determine type/placement of SW, SZ, BZ, and CLZ mines/obstacles.	AS ML(A) COBRA	SMCM AMCM UMCM
Hostilities	ARFOR 2	Airfield Recon and Establish Lodgement	Reconnaissance, seizure, and hasty defense establishment of airfield sector.	ASTAMIDS CIMMD	AN/PSS 12
Hostilities	NAVFOR 3	Amphibious Assault	Clear mines as necessary and land sufficient forces to secure beachhead.	EN(ATD)	AMCM SMCM AAV MK1 UMCM
Hostilities	MARFOR 1	Follow on clearance	Expand CLZ and ingress/egress lanes.	EN(ATD) JAMC	SMCM AMCM UMCM
Hostilities	MARFOR 2	MEF Route Recon	Determine minefield location between beachhead and port objective.	COBRA	None
Hostilities	ARFOR 3	Route Recon and Clearance	Clear route from airport sector to port objective area.	ASTAMIDS CIMMD ORSMC	AN/PSS 12
Hostilities	MARFOR 3	MEF Movement to Port Objective	Clear route for MEF(FWD) from beachhead to port objective area.	ORSMC	AN/PSS 12

the ACTD, we produced similar divisions for each sub-phase in Table 2. Two important points need to be made regarding these measures.

First, they were readily calculated with data that were easily collected during Demo I. Secondly, there were no pre-defined thresholds accompanying any of the MOPs or MOEs. Unlike other test programs, for instance Operational Evaluations, success of any particular system for an ACTD does not depend on it meeting some performance standard. For ACTDs, success depends on making the right acquisition decision based on properly characterized performance, leading to an understanding of how a system will enhance military utility.

Countermeasure Sub-phases of the JTFEX

Typically no significant countermine play exists in a JTFEX.[7] Early in our planning process, we developed a concept for overlaying a countermine component to the JTFEX that would satisfy the test and evaluation objectives of the ACTD. Our concept for a countermine scenario includes four facets:

- Naturally motivate the use of the novel systems.
- Provide the maximum opportunity to demonstrate significant (i.e., measurable) utility of each novel system to the top-level MOEs and COIs.
- Demonstrate synergy of the novel systems with the legacy systems.
- Present a significant but fair challenge to each novel system.

In addition to these four objectives, we wanted to minimize our impact on the JTFEX. Therefore, we imposed the restriction on ourselves of maintaining consistency with the JTFEX Military Capabilities Summary, which defines the threat, political situation, and military mission for the JTFEX.

Figure 2 shows an overview of the countermine overlay to the JTFEX. The geopolitical situation is largely defined by the JTFEX Military Capabilities Summary mentioned earlier. The additional activities to showcase the countermine systems satisfy the four objectives discussed previously.

The overall scenario for the countermine demonstration is only the first step in producing a context for the evaluation of the military utility of the novel systems. The next step is to further divide the scenario into sub-phases that are amenable to analysis. That is, we wanted to have self-contained military operations that could be simulated as well as played in the JTFEX to produce meaningful results. The results would then serve to support the user's ultimate evaluation of the improvement in capability provided by particular novel systems.

Toward that end, we divided the JTFEX scenario into 10 sub-phases that accomplished the goal of focusing the evaluation on individual systems. Table 2 shows a description of these sub-phases.

General Analysis Approach

After dividing the JTFEX into manageable sub-phases, and establishing the basis for measuring the military utility of the participating systems, we still worried that these two exercises alone will not provide enough data to support the overall objectives of the ACTD. As a result, we proposed that the basis for evaluating the results of the ACTD should be to understand as much about the performance of the novel systems as possible before the ACTD demonstrations.

The basis of this understanding can come from tests conducted by the system developers, M&S, or special "cell demonstrations" requested by the ACTD Joint Program Office or the user [USACOM].

Figure 3 illustrates the relationships among the ACTD demonstrations and supporting tests, the analysis process, the models that describe the behavior of the novel and legacy systems, and the campaign model that plays these performance factors through representative scenarios to produce estimates of the improvement in countermine capability provided by the novel systems.

Figure 3 represents an iterative process. At any time, the models implemented in JCOS represent the best, current understanding of countermine capability. As more performance data are collected, this understanding improves, and so do our estimates of the contribution of the novel systems.

Consistent with the ground rules of the ACTD, the primary data for making decisions about the novel systems will come from the demonstrations themselves. However, having as much prior or supplemental knowledge of novel system performance allows the evaluator to predict how the ACTD scenarios would benefit from the presence of these systems.

After the demonstrations, the analysis agents will compare the observed performance during the ACTD against these predictions. Two outcomes can result:

- For any novel system, the observed performance during the demos can be consistent with our expectations based on M&S. In this case, we can be assured that we understand the contribution of that novel system to the countermine mission.
- For any novel system, the observed performance can be inconsistent with our expectations. In that case, we need to do one of the following: reassess the predictions

FIGURE 2. Relationship of Military Capabilities Demonstrated During JFTEX to Each ACTD Phase

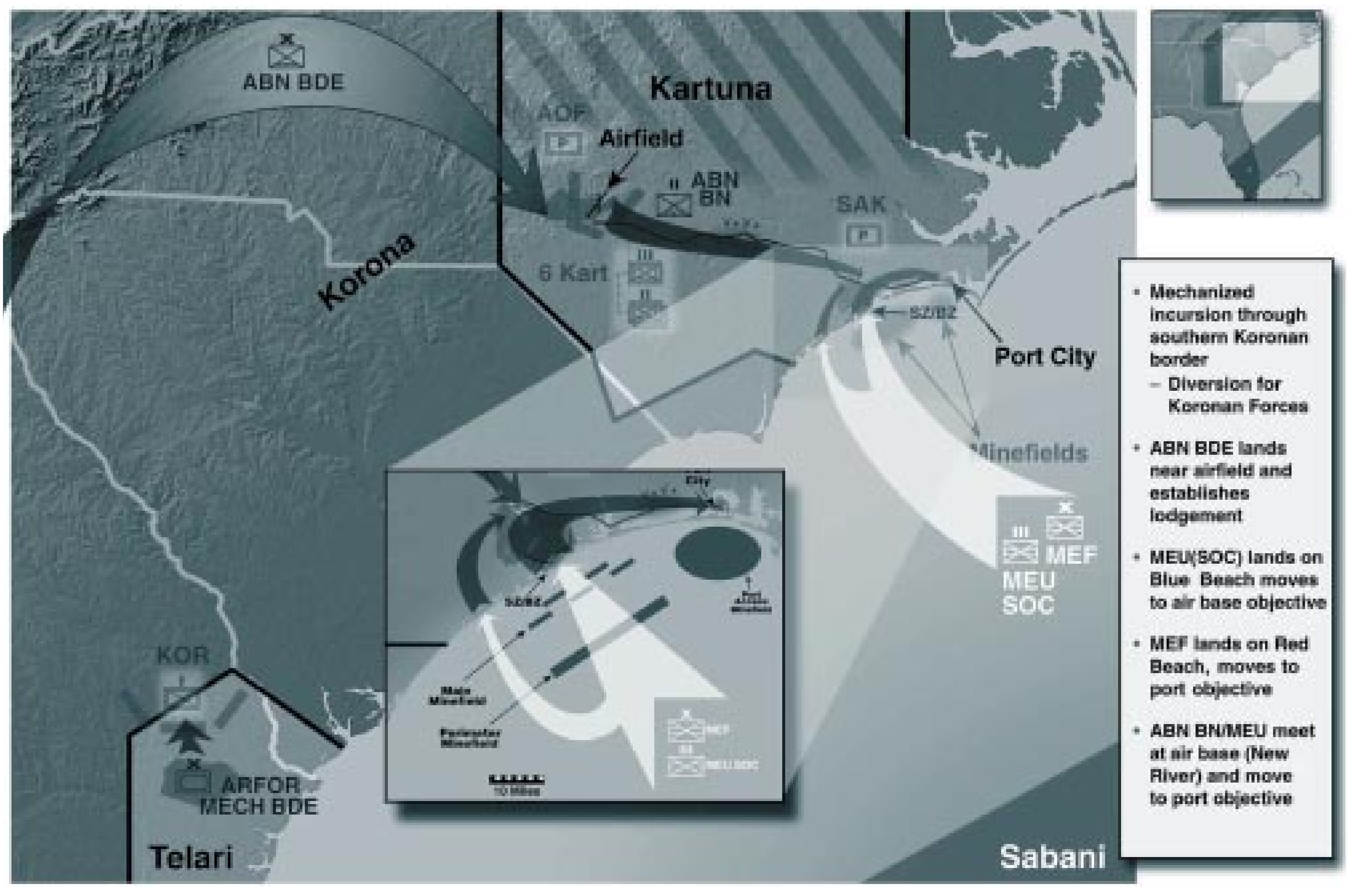
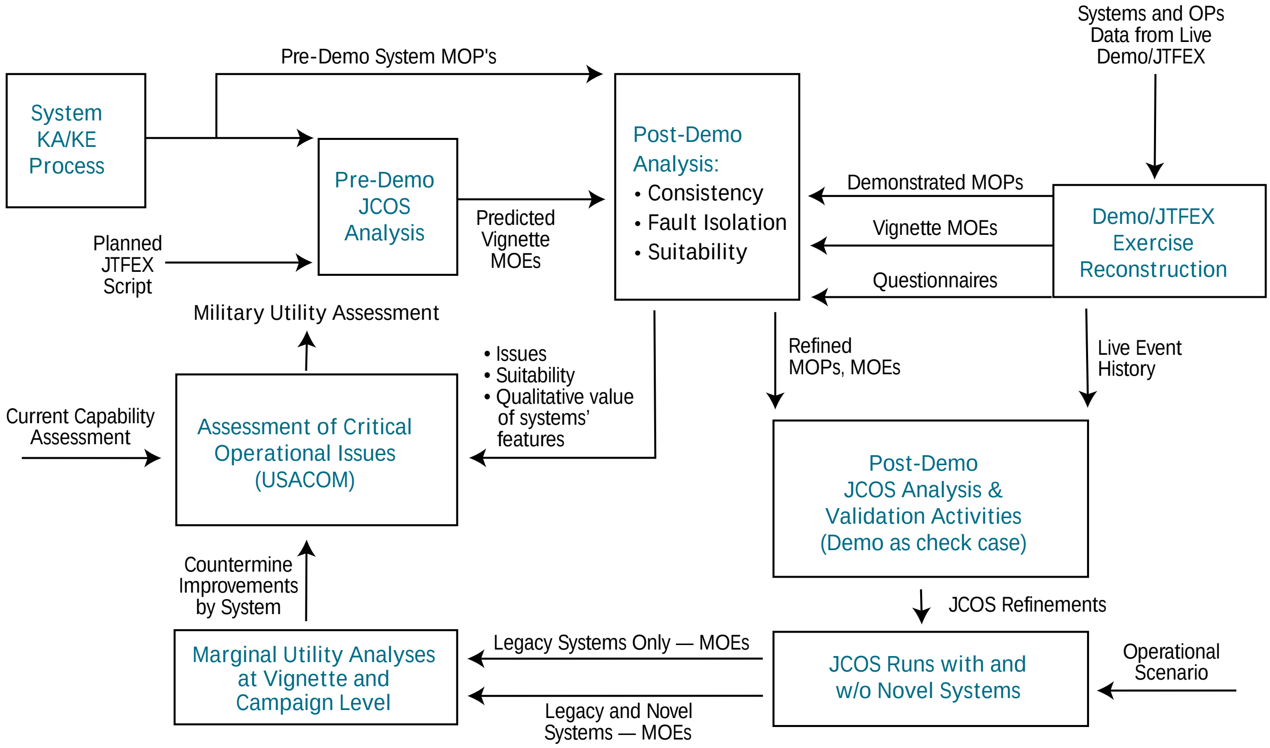


FIGURE 3. M&S As a Means to Form Best Estimates of Countermine Capability Improvements



and prediction tools, or reassess the validity of the a priori knowledge of the novel system's performance.

As discussed earlier, this general approach assumes that there is a body of test data or other assessments of the capability of the baseline systems as well as the novel systems. The JCM ACTD community is beginning to collect information on the expected performance of novel systems, but this information varies considerably in its credibility and the level of testing that supports it. We are still determining the degree to which baseline systems are understood.

Analysis Issues

We identified five areas that affect our ability to conduct the analysis necessary to support the ACTD goals and objectives. Some of these issues can be handled with quantitative or statistical methods, and some of these issues will be dealt with anecdotally.

For example, participants and knowledgeable observers may be in a position to evaluate reliability, maintainability, and availability (RM&A) problems, and synergy or interference between systems. Other issues, such as our knowledge of relatively immature systems, or the affordability of instrumentation, affects the demonstration planning process and constrains the level of our analysis.

Relative Maturity of Novel Systems

The maturity of the novel systems ranges from being past initial operational capability (e.g., the Near-term Mine Reconnaissance System planned for use in Demo II) to the unavailability of prototype hardware (e.g., the Advanced Lightweight Influence Sweep System). As a result, the availability of representative test data and/or valid models is an issue.

For systems with a long history of test and evaluation, our expectations of system performance may be well grounded. The performance of these systems during the demonstrations may have little impact on our estimates of their contribution to the countermine mission, other than to confirm what we already believe.

On the other hand, if very little is known about some systems, we run the risk of attributing more capability to them than appropriate. If only they would work as advertised, they would have enormous military utility.

Treatment of RM&A

Novel systems selected for test and evaluation in the JCM ACTD may not be at the stage of development or readiness for operation by sailors, soldiers, or Marines in the military environment. In real-world situations, however, RM&A issues often determine whether or not a system has any value to the assigned mission.

At one level, we have some concern that an unfortunate failure of a novel system will cause it to be discounted as a useful military system, regardless of how preventable the failure is in the future. At another level, we are concerned that real RM&A concerns will not receive proper exposure because of the involvement of technicians and specially trained operators in the ACTD exercises.

Synergy and Interference

One reason to run the ACTD with so many systems participating is because their real utility may be enhanced by the performance of other baseline or novel systems. That is, two systems operating together might possibly demonstrate more countermine capability than you would expect if each were tested separately. On the other hand, two systems that perform satisfactorily in isolation might possibly interfere with each other when operated together.

We cannot predict these effects ahead of time, but certainly we need to consider these possibilities in the analysis of the demonstration results. One place where these effects might be observed is in a clearing system that follows a reconnaissance system. One can imagine that a navigation error in the reconnaissance system would be inherited by the clearing system, causing it to be less effective than otherwise expected.

Another place where these effects might be noticed is in C^4I, where the fusion of data from two reconnaissance systems provides more credible situational awareness than might have been expected if the output of the systems were viewed in isolation.

Instrumentation

Some instrumentation will be provided with the novel systems under test. Currently, however, the community has not addressed other instrumentation requirements such as those required for environmental measurement, geographic tracking of participating units, and measuring the performance of baseline or legacy systems.

Part of the evaluation process was to establish ground truth for the various phases of the exercises. That is, we wanted to know, independent of the systems being evaluated, the state and extent of the mine threat. Moreover, the performance of all systems being considered depended on environmental factors. This fact made it necessary to collect some amount of in situ environmental data, such as water conditions, atmospheric conditions, sea state, etc.

C^4I Considerations

A major expectation of the ACTD was that a C^4I capability would be demonstrated that supported seamless, no pause transition from the sea to the land battle in a mine environment. To do so, this C^4I system must provide an accurate and timely picture of the battle space, including the progress of countermine activities. In fact, timeliness and accuracy of C^4I is one of the factors that makes the goal of seamless transition from the sea to decisive land battle possible.

The availability of the C^4I network resolved some of the more complex instrumentation issues. We used copies of the C^4I database for near real-time reconstruction of the demonstration, focusing on critical countermine events and processes. After the exercise, this database provided us the means to determine the performance of the novel and legacy systems and to evaluate the effectiveness of the suite of countermine systems during each sub-phase of the demonstration.

Analysis Flow

With the previous discussion as background, we proposed an analysis flow that accommodates systems of varying levels of maturity and of which we had varying levels of understanding. In addition, we suggested a methodology that covers a wide range of outcomes during the demonstration exercises.

The analysis flow is divided into two parts: first is the integration of cell demonstrations and other data into the evaluation; and the second is the estimation of top-level MOEs based on the ACTD exercises and campaign-level simulations.

Use of Cell Demonstrations and ATD Test Program Data

Figure 4 shows an analysis flow for making the best estimate of each system's expected performance in the context of the ACTD exercises. In the best case, we understand enough about a system's capabilities to estimate its contribution to top-level MOEs without further testing and analysis. For other systems, we will want to collect more data, run simulations, or otherwise improve our understanding of its relevant performance factors. In some cases, so little may be known about a system's capabilities that we will decide not to include it in the ACTD exercises.

The decisions and processes summarized in Figure 4 are intended to produce refined estimates of each system's MOPs, so that we can make the best possible estimates of campaign-level MOEs to compare to the observed results during the ACTD exercises.

As discussed earlier in this article, our knowledge of each system's capabilities, i.e., its MOPs, is pivotal to meeting the ACTD objectives. We need to be able to predict the likely range of outcomes for each phase of the exercise so that we can determine how likely the observed results are. The next section of this article summarizes how we would use this information in assessing the military utility of the novel systems.

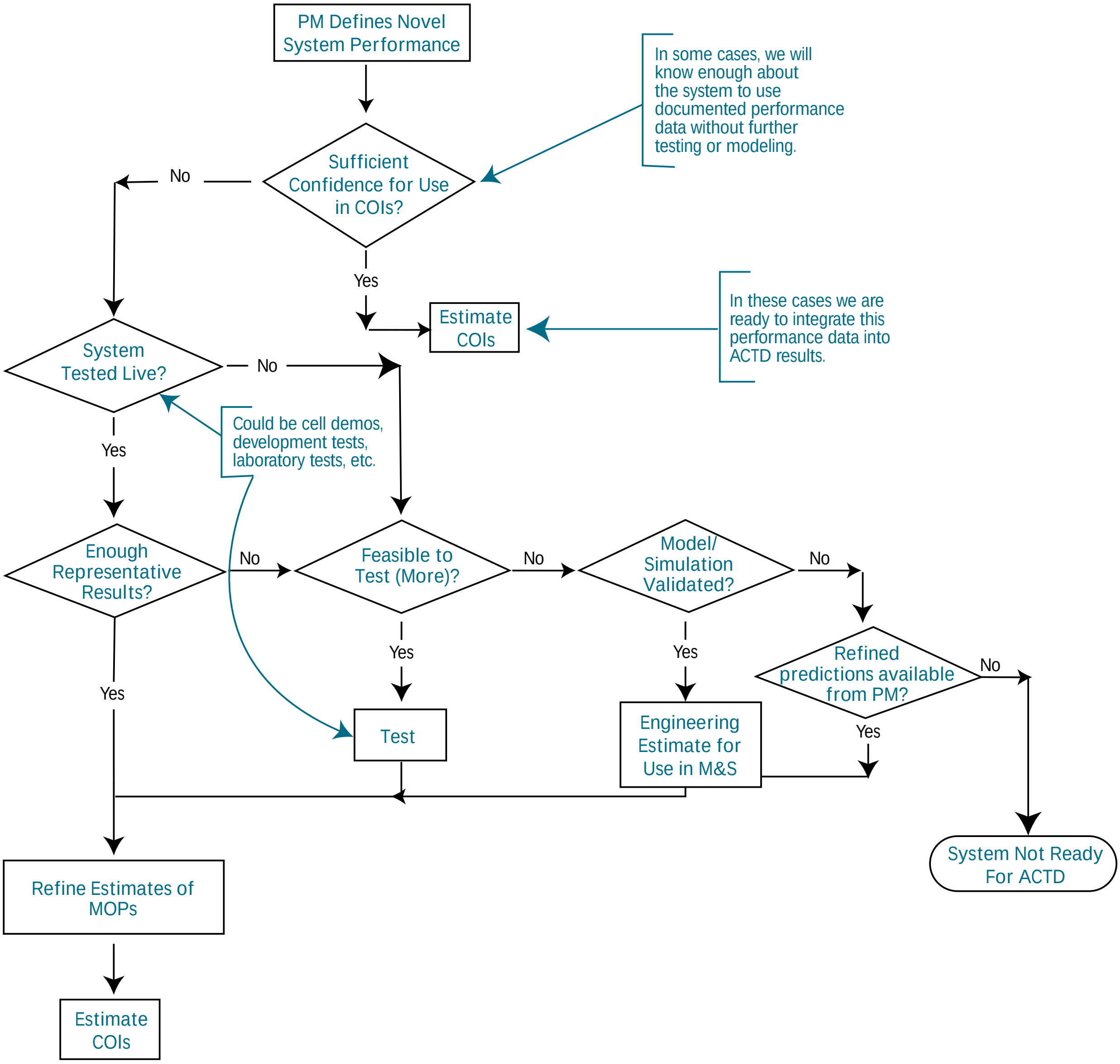
Use of ACTD Demo Results and Campaign-level Simulations

Figure 5 provides the details of the analysis described earlier. Once we have the best possible estimates of each novel system's performance, we calculate the contribution to top-level MOEs by including the system performance factors into high-level simulations of the ACTD scenarios.

The output of these simulations provides insight into the improvement represented by the novel systems over what can be achieved with baseline systems. Sources of variation in performance or environment would be included by examining the sensitivity of the MOEs to excursions in input parameters.

JCOS provides us the capability for this modeling. This sophisticated, campaign-level simulation tool models all of the environmental factors and system interactions that relate to the countermine situation. For practical reasons, we began with simpler models that treat the interactions among the systems, mines, barriers, and obstacles in a straightforward way. This process will give us an early look at the appropriateness of the demonstration scenarios as well as provide initial, baseline estimates of the military benefit of the novel systems.

FIGURE 4. Analysis Flow — Basis for Evaluating Observed Performance



Once the actual demonstration exercises are conducted, the results are evaluated against our expectations. If the demonstrated performance of a particular system is consistent with the expectations, we can claim that we understand the contribution of that system to the success of the campaign. If the performance is not consistent with expectations, we will isolate the cause of the problem and adjust our estimates of that system's contributions accordingly. Figure 4 allows for various reasons for unexpected performance, including problems with the predictions, unexpected changes in the scenario or environment, and/or system malfunction.

Figure 5 depicts two aspects of system performance that we mentioned earlier in this article. One aspect is functional performance. That is, are enough mines located or cleared in the time frame required? This type of performance is the one most amenable to a quantitative analysis by comparing demonstration results to expectations from M&S.

The other aspect of performance is related to RM&A, suitability for military use, and other factors not easily measured. We can expect that the observations of participants and exercise monitors will provide the best source of this information. In the analysis flow shown in Figure 5, we allow for adjustments to our assessments of military utility based on knowledgeable predictions of the effect of future modifications on system performance.

Lessons Learned from Demo I

Because this article is about process and methodology, we will present some of the lessons learned from the first demonstration, without commenting on the specific performance of individual systems. Demo II should include an expanded staff planning phase, which more thoroughly examines and integrates intelligence, surveillance, and reconnaissance; C^4I; and simulation, and assesses their impact on staff decisions. The planning phase was inhibited during Demo I due to the late stand-up of component staffs and the compressed, scripted nature of the ACTD play in the exercise. During the execution phase, each novel system should be re-played in essentially the same role that they had for Demo I (although in a free-play task/response mode) with much greater use of simulation, especially for legacy systems. Because Demo II will be in the spring of 1998, this should offer an opportunity to leverage the staffs and possibly operational forces' experience with the ACTD prior to the usual summer turnover. Finally, environmental and threat applicability of some novel systems should be fully considered by planning staffs because novel system performance is dependent on these actors.

Summary and Conclusion

The success of the Joint Countermine ACTD depends on its ability to satisfy ambitious goals and objectives. Ultimately, the program is to provide users the information needed to support investment decisions on a broad spectrum of individual ATDs. Our view is that to meet these goals, we will need to have a solid understanding of each system's likely contribution to a countermine mission before its use in one of the actual ACTD exercises.

The exercise data, when combined with simulations and other test data, will provide a realistic assessment of the performance of the novel and baseline systems, operating together, in a representative countermine scenario.

Endnotes

1. Statement by the Deputy Under Secretary of Defense for Advanced Technology to the Subcommittee on Defense Technology, Acquisition, and Industrial Base of the Senate Armed Services Committee, March 8, 1994.
2. Demonstration II (Demo II), planned for fiscal 1998, emphasizes the technologies of clandestine surveillance and reconnaissance and demonstrates all elements of a seamless transition of countermine operations from the sea to the land.
3. Joint Countermine Advanced Concept Technology Demonstration Management Plan, September 1995.
4. Joint Service Manual (JSM) 3500.04 (ver 2.1) Universal Task List.
5. During the first large-scale demonstration in August 1997, USACOM conducted data collection and analysis.
6. JSM 3500.04 (ver 2.1) Universal Task List.
7. JTFEX 97-1, conducted in the fall of 1997, included significant mine warfare play for the first time in recent memory. In this exercise, the detected presence of a minefield caused the Commander, Amphibious Task Force to revise his landing plan.

FIGURE 5. Comparison of Observed Results to Predictions